

CHAPTER VI - TROPICAL CYCLONE SUPPORT SUMMARY

The Pocket Tropical Cyclone Model (PTCM)

(Evans, J. L., Monash University, Australia and
R. J. Miller, NAVENVPREDRSCHFAC)

The PTCM is a linear tropical cyclone motion prediction scheme incorporating the effects of large-scale environmental flow and west-northwestward propagation due to the rate of change of the Earth's vorticity over a given distance or (Beta-effect). The model is based on equations developed by Holland (1983) and has been operational in a modified form in the Australian region for a number of years. The current version of the model has been modified to accept FNOC data and produce up to 72-hour forecasts. The model is ready for testing.

The PTCM is being incorporated in the NEPRF Tropical Cyclone Forecast Simulation package which will be a resident program in the ATCF.

Tropical Cyclone Motion Diagnostic Tool

(Chu, J. H., NAVENVPREDRSCHFAC)

Based on the barotropic vorticity equation, a set of "Typhoon Motion Equations" has been developed. These equations can be used to diagnose interactions between the tropical cyclone and its environment. The equations provide forecasters with information on the impact of environmental changes on tropical cyclone motion. The equations have been tested using input of theoretical or analytical fields. Plans have been made to adapt these equations to FNOC fields and incorporate them in the Tropical Cyclone Forecast Simulation Package.

The Advanced Tropical Cyclone Model (ATCM)

(Hodur, R. M., NAVENVPREDRSCHFAC)

The ATCM was run in 1988 for use by JTWC forecasters. As in 1987, the ATCM again exhibited a strong northward bias. This bias was particularly evident with storms located deep in the tropics, despite numerous changes made after the 1987 tropical cyclone season. Also, erratic behavior was noticed on some forecasts of reasonably well-behaved storms. A description of problems discovered in the 1988 version of the ATCM follows.

The first problem concerns the data assimilation strategy used in the ATCM. Although the ATCM is not run until about six and a half hours after observation time, only those observations received up to three and a half hours after observation time were used. The ATCM used an assimilation cycle of 12-hours, as opposed to 6-hours for NOGAPS. This meant that all late and off-time data was not used by the ATCM, resulting in degraded analyses. In 1989, the ATCM will use either a later data cut-off time or NOGAPS analyses. Second, the radiation parameterization in the ATCM caused excessive cooling of the atmosphere and produced noise in the model. Noise due to clouds appears to contribute the largest error to tropical cyclone track forecasts. An improved treatment of clouds, based on that used by the European Center, is being tested in the ATCM and will be implemented prior to the 1989 tropical cyclone season. Test runs of several 1988 storms, using NOGAPS analyses and no clouds, have shown dramatic improvement in forecasting tropical cyclone tracks. Finally, the ATCM exhibits a northward bias during the first 6- to 12-hours of a forecast. This occurs even without physical parameterizations and has been related to either biases in the initial fields or the structure of the bogus circulation. A similar tendency has been noted by the National Meteorological Center for tropical cyclones in the Atlantic Ocean. Experiments with simple basic flows are being performed to isolate the cause of this erroneous movement.

Navy Tactical Applications Guide (NTAG), Volume 6

(Fett, R. W., NAVENVPREDRSCHFAC)

An effort is now underway to develop a series of examples demonstrating the use of high quality satellite data for analysis and forecasting in the tropics. Data from polar orbiting and geostationary satellites are used to study the evolution of certain weather effects or of a particular weather phenomenon at a given time. These examples are organized and collated for publishing in the NTAG Volume 6. NTAG Volume 6, Part I, "Tropical Weather Analysis and Forecast Applications," was distributed in June 1986. Part II, "Tropical Cyclones," is scheduled for completion in January 1989. In March 1989, work will begin on the development of the "Tropical Cyclone Forecaster's Handbook."

Automated Tropical Cyclone Forecasting System

(Tsui, T. L., R. J. Miller, and A. J. Schrader,
NAVENVPREDRSCHFAC)

The Automated Tropical Cyclone Forecasting (ATCF) system is an IBM PC compatible software package currently being developed for JTWC. The ATCF is designed to allow JTWC forecasters to graphically display tropical cyclone forecast information, merge and analyze synoptic wind fields, provide objective fix guidance, select optimum objective forecast aids, and expedite the issuance of tropical cyclone warnings. One great advantage of the ATCF is standardization of tropical cyclone forecasting procedures. During the course of preparing a tropical cyclone warning, forecasters will avoid neglecting decisional steps or available options. The ATCF automatically saves all tropical cyclone data, computes real-time and post storm statistics, and allows forecasters to randomly access any past storm data. A communications package included in the ATCF simplifies data transfer between JTWC and FNOC.

The ATCF was installed at JTWC in January 1988 and activated for operational use in June 1988. The system was also installed at the AJTWC (located at NWOC) during October 1988. The system software has been provided to OAO Corporation for inclusion in the JTWC Automation Project.

North Pacific Tropical Cyclone Climatology

(Miller, R. J., T. L. Tsui and A. J. Schrader,
NAVENVPREDRSCHFAC)

A tropical cyclone climatology for the North Pacific has been compiled and reviewed by EGPACOM and published by NEPRF. Data used for the western basin were taken from the JTWC Tropical Cyclone data base and covered a 40 year period from 1945 to 1984. Eastern basin data spanned a 34 year period from 1949 to 1982 and were obtained from the consolidated world-wide tropical cyclone data base at the National Climatic Data Center in Ashville, North Carolina. Tropical cyclones for both basins were sorted by day and month into twenty four 31-day overlapping periods. For each period, four charts are supplied: 1) actual storm paths; 2) mean storm paths; 3) average storm speed; and 4) storm constancy and frequency.

EOF Post-Processing Forecast Technique

(Chu, J. H., R. J. Miller and T. L. Tsui,
NAVENVPREDRSCHFAC)

NEPRF has adapted the Empirical Orthogonal Function (EOF) tropical cyclone post-processing forecast scheme on the FNOC computer system. This EOF technique, developed by the Naval Postgraduate School, objectively recognizes salient patterns of large-scale horizontal wind fields relative to the center of a tropical cyclone. This information, in terms of EOF coefficients, is used via regression equations to modify tropical cyclone track forecasts produced by numerical models. Test results will be compiled after the 1988 western North Pacific tropical cyclone season.